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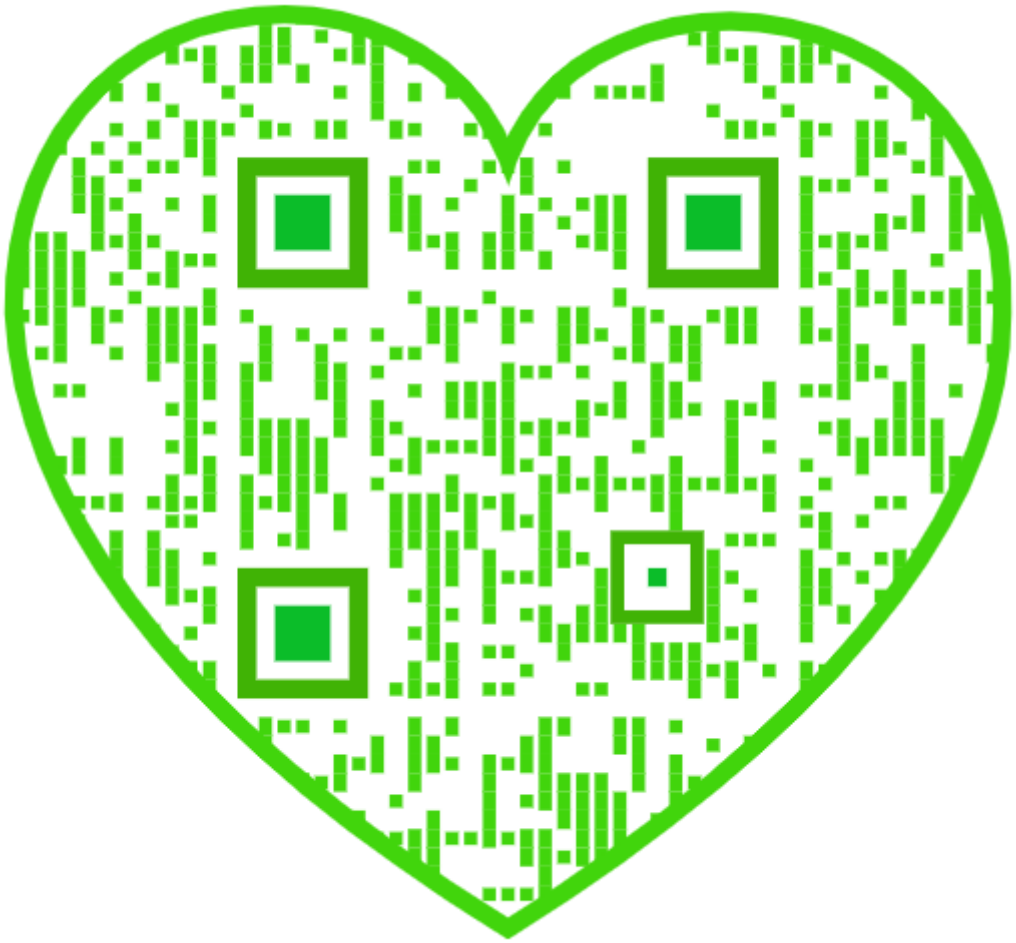

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A TREATISE on Commercial Starters in Butter *and* Cheese Making.

by MARTIN H. MEYER

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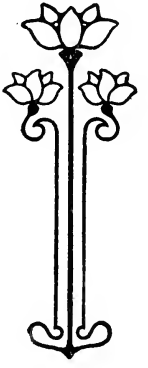

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PUBLISHERS' INTRODUCTION.

It is all very well for manufacturers of a specialty like a pure culture of Lactic Ferment to work out from laboratory tests, directions and rules for its application in the creamery and the cheese factory. But when the practical dairyman is confronted with the actual work and possibly meets with difficulties not anticipated by the scientist, he is apt to be puzzled and to find fault with the preparation. In the dairy business there is perhaps no other work that requires so much practice combined with good common sense as the preparation of the starter, and this is especially true in creamery butter making. No one is qualified to give directions and advice in regard to this work who has not had a thorough training and long experience in this particular line.

It is therefore with genuine satisfaction that we avail ourselves of the permission of the author of this pamphlet, Mr. Martin H. Meyer, to publish in advance his treatise which we understand is a chapter from a practical handbook in butter making soon to be issued. With his training as a practical butter maker, an instructor at the dairy school, and an extensive traveler among the creameries, perhaps few men are better qualified to give advice as to the preparation of the starter, and as this is practically the first attempt of a comprehensive treatise on this important subject we feel sure that all progressive dairymen will hail it with delight.

CHR. HANSEN'S LABORATORY.

FOREWORD

During the last decade the use of commercial starters in American butter and cheese making has become indispensable in the production of first-class butter and cheese.

A greater practical knowledge of the use, propagation and perpetuation of lactic acid fermentations is not only considered advisable but essential in modern dairy education. Our aim is to increase the knowledge of the use of commercial starters and this can best be accomplished by learning from each other's experience.

In view of the great importance of the use of lactic ferment cultures in dairying a few plain, reliable, tried and tested facts are presented in this booklet for the reader's kindly consideration.

MARTIN H. MEYER.

Sept. 1, 1909.

COMMERCIAL STARTERS IN BUTTER AND CHEESE MAKING.

Success in Butter and Cheese making Rests Primarily Upon the Extent of Our Knowledge of the Fundamental Principles Involved in Controlling Lactic Acid Fermentations.

In proportion as we gain knowledge of the use of a pure Lactic Ferment Culture in butter or cheese making do our methods change and readjust themselves to changed conditions. Where improper methods still prevail financial returns are less and poor quality of butter and cheese is not uncommon. Even with modern methods of manufacture there are times when the quality of butter and cheese is not as good as it might be. This in a measure is due to the lack of knowledge of a wonderful flavor-producing organism called the Lactic Acid germ. This little plant is today looked upon as the greatest money-making organism of any affecting milk and its products. The lactic acid germ is the most vigorous germ, under normal temperatures with which the dairyman has to deal and when properly cared for it is his best friend and is used as a medium through which a great many difficulties arising from abnormal fermentation in milk or cream may be overcome. By its careful use abnormal fermentations affecting the quality of butter and cheese may readily be prevented and the best flavor insured. It is known to both butter and cheese makers that by using a good

pure culture of Lactic Ferment in the manufacture of their products, the value has been increased from one to two cents a pound; in some cases as much as five cents.

COMMERCIAL STARTERS IN BUTTER MAKING.

Butter making today without a starter is like running machinery without oil. Whenever a prosperous creameryman is found you are sure to find that a commercial starter is used in the manufacture of his butter because pure lactic acid enhances the keeping quality of butter.

Various methods of handling and souring cream have been tried but so far the best results have been obtained by using a large quantity of a pure starter, and ripening the cream to about .55% acidity. Lactic acid acts as a germicide on obnoxious germs and prevents the development of bad flavors and taints present in cream or milk.

A good Lactic Ferment is a great purifier and should be used by every butter maker. Gas or yeast organisms have an injurious effect on the aroma, flavor and body of butter

As a further proof of the value of a pure lactic acid culture in butter making I may mention that at the Educational Scoring Exhibitions now carried on in all dairy states the highest average scores are, in every instance, received by exhibitors of butter and cheese who use a pure culture.

COMMERCIAL STARTERS IN CHEESE MAKING.

Among modern developments in the art of cheese making there is perhaps no other one factor which influences the quality of the product to a greater extent than the use of a good commercial starter. Recent experience seems to demonstrate the fact that successfully prepared and properly used, starters are invaluable in modern cheddar cheese making. It is today a universally recognized fact among up-to-date cheese makers, that a good commercial starter is one of the main factors in controlling abnormal fermentations in cheese.

Prof. F. C. Harrison's experiments show that gas producing bacteria produce a bad odor and flavor and also cause a mottled appearance in cheese. When gas producing bacteria were present the good effect of the lactic acid starter was very noticeable and caused a great improvement in the flavor and appearance of the cheese. We know also that when abnormal fermentations predominate the flavor and texture are to a greater or less extent impaired. It is evident that some controlling factor is essential when we consider that in some cases cheddar cheese has been known to actually "walk off the shelves." It is necessary then in order that this stage of fermentation may not be reached, that a pure, especially selected lactic acid culture be used.

CONDENSED DIRECTIONS FOR BUILDING UP THE STARTOLINE AND STARTER FROM A PURE CULTURE OF LACTIC FERMENT.

(a)—PREPARING THE STARTOLINE OR MOTHER STARTER.

1. First we inoculate a small quantity of pasteurized milk with a pure culture of lactic ferment, known in the market as Lactic Ferment Culture. This when coagulated makes the first propagation and is called Startoline. Startoline is the small quantity from which larger quantities are grown.

2. The next day when this milk is sour or sufficiently ripened a small quantity of it is added to fresh pasteurized milk. This is the second propagation.

3. A third propagation is made in the same way, by adding a little of the second propagation to pasteurized milk, a fourth in the same way and so on day after day until the starter shows signs of deterioration when it becomes necessary to prepare a new batch of startoline with a fresh commercial starter.

(b)—PREPARING THE STARTER.

While the propagation of Startoline is carried on day after day for an indefinite time as before indicated, a sufficient quantity of it should be prepared every day after the second or third propagation, not only to perpetuate the startoline itself but also to inoculate the starter milk. The starter when fully ripened is used

in the cream for butter making or the milk for cheese making.

In carrying out the processes as outlined above the first thing to be taken into consideration is:

THE SELECTION OF MILK.

To obtain the best results it is necessary to use only the cleanest, sweetest and freshest milk, from a healthy herd and from one having few strippers. Stripper milk being too viscous and lacking fine flavor is not as good for starter making as fresher cow's milk. Mixed milk as it is generally delivered at the creamery or cheese factory is unsatisfactory for making a first-class starter. The best milk, either evening or morning milk should be used. An observant operator soon learns which of his patrons brings the best milk for starter making and this is the milk to use. Milk having an old taste will impart the same to the starter. In fact defective milk will produce a defective starter even though the best of care has been exercised in the handling of it. An experienced butter or cheese maker soon learns how to tell old or kept over milk from new or fresh milk even though both are cold. The new or morning milk always is soft and velvety to the palate, while old milk is harsh to the palate and lacks fineness of flavor.

PREPARING MILK FOR THE FIRST PROPAGATION.

The preparation of milk for the propagation of a pure culture is very simple. Select two quarts of good

sweet whole milk or skim milk for this purpose. (Either may be used satisfactorily but sweet whole milk gives the startoline more of a smooth, pleasing taste than skim milk does). Set two vessels each containing one quart of milk into water and heat it to 170° F.—190° F. and hold at this temperature for about forty minutes. Cool quickly to 80° F. and it is then ready for the addition of the pure culture. For very large creameries use a large sized bottle of pure culture and use one gallon of milk divided into two jars of two quarts each. An excellent method is to place the jars of selected milk in a steam tight, wooden, tin-lined box the temperature of which can be perfectly regulated and pasteurization assured. Another method is to tie parchment paper over the necks of the jars and then place the jars on a shelf through which steam is conducted. Turn a large tin pail over them, turn on the steam and heat as mentioned above. Then cool by placing the jars first in warm water (to avoid breaking them) and then gradually running cold water around them.

ADDING THE LACTIC FERMENT CULTURE.

When the milk is prepared as previously directed get the little bottle of pure culture, clean the sealing wax carefully from the neck of the bottle and empty one-half of the contents into each bottle of the pasteurized milk. Now close the jars or vessels containing the milk being careful not to get any dust or impurities into the milk. Shake the jars five or six times at intervals of

three or four minutes, then let stand at a temperature of about 80° F. until nicely coagulated. This is called the first generation and each consecutive propagation is one generation. Thirty consecutive propagations are thirty generations. Each souring is considered one germ life and therefore we have one generation at every propagation. Whether the milk is pasteurized in the same vessel in which the startoline is to be grown or in a separate vessel and the startoline jars sterilized before putting the milk into them, the milk should always be in the jars before the culture is put into it. After the culture has been added to the milk and it has coagulated it is called "Startoline."

THE SECOND PROPAGATION.

The milk used for the second propagation is handled the same as the milk used for the first inoculation of the pure culture, except that the temperature at which the milk is set should be 75° F. or about five degrees lower than the temperature used for the first propagation This temperature may vary slightly according to the methods employed and to the skill of the person handling the starter. Add about two tablespoonfuls of sour milk from the first propagation to each quart of the milk for the second propagation and use about the same proportions for each succeeding propagation.

THE THIRD PROPAGATION.

Whenever it is necessary to make more than two propgaations of a pure culture before it is used for in-

oculating the starter milk to be used in butter or cheese making set the milk for the startoline at about 70° F. If the second propagation is used to inoculate the starter milk set the starter milk at about 72° F. in winter allowing a few degrees for the lowering of the temperature. Set it at about 68° F. in summer. The subsequent propagations may be set at temperatures ranging from 65° to 70° F. depending upon the quantity of startoline used and temperature of the room

HANDLING THE STARTOLINE.

From the foregoing we see that we obtain our startoline by inoculating pasteurized milk with a pure Lactic Ferment Culture and allowing it to coagulate. For the perpetuation of the startoline the milk may be taken daily from the can of milk pasteurized for the starter, or it may be prepared as directed on page 9.

Have the pasteurized milk and the startoline jars ready, break up the coagulated startoline by shaking and add about two tablespoonfuls to each jar filled nearly full with the pasteurized milk. Now shake thoroughly and set at a temperature of 65° F to 70° F. Vary the quantity of startoline added to each jar according to the conditions of the startoline and to possible variations in temperature during the ripening process. In ordinary room temperature (68° F.) when two tablespoonfuls of startoline are added to the milk it will coagulate in 12-18 hours. When the startoline is in danger of getting overripe before it can be used break it up thoroughly and pour

out about one-half; then fill the jar again with pasteurized milk, shake well and set in a cool place. This will lower the acidity and give the lactic acid germs a chance to multiply and retain their vitality which is essential in growing good startoline.

STARTOLINE INCUBATORS.

There are various contrivances on the market made especially for the purpose of handling the startoline or "Mother Starter." These may be obtained from any reliable creamery supply house at a reasonable cost. They are so made that a uniform temperature can be maintained during the ripening of the startoline. This uniformity of temperature is necessary for obtaining good results. Where electricity can be had a very uniform temperature is easily maintained by placing one incandescent bulb in the interior of the incubator and turning on the electricity. A common, double-walled, tin-lined, wooden box can be used with success in this manner. In very cold weather if there is danger of the room temperature dropping too low, two bulbs may be used instead of one.

THE HANDLING OF THE STARTER.

The care to be exercised in selecting, heating and cooling milk for the starter is not necessarily different from that to be exercised in the handling of the milk for the startoline. The can or cans used for making the starter should be well tinned and all seams should be

smooth to allow it to be easily and thoroughly cleaned. Old cans, especially when the tin is worn off or when they are somewhat rusty will impart a "tin can" flavor to the milk which will impair the usefulness of the milk for starter making. The best starter cans are those which produce a vigourous whirling of the milk to prevent scorching while heating and to facilitate rapid cooling. The percent of startoline necessary to be added to the starter milk depends, **first** on the temperature of the starter milk when the startoline is added; **second** on the average temperature at which the milk will be kept during the ripening period; **third** on the time allowed for the starter to ripen before it is to be used; and **fourth** on the vigor and acidity of the startoline added.

TABLE I.

Quantity of Milk, lbs.	Quan. of Milk approx. gal.	Range of Temperatures		Startoline added expressed in		
		In Winter.	In Summer.	Lbs.	Per Cent.	Quarts.
100	12	68–70° F.	62–67° F.	1–5	1–5 +	½–2½
200	24	68–73° F.	63–67° F.	2–10	1–5	1–5
300	36	68–73° F.	63–68° F.	3–15	1–5	1½–7½
400	48	68–71° F.	64–68° F.	4–20	1–5	2–10
500	60	68–70° F.	65–68° F.	6–25	1 +–5	3–12½
1000	120	68–70° F.	68–70° F.	15–40	1½–4	7½–20
5000	600	68–70° F.	68–70° F.	100–500	2–108	50–250

Explanation of Conditions Indicated on Page 14.

The larger the per cent. of startoline added to the starter milk and the higher the temperature at which it is kept, the shorter is the period of time between the inoculation and coagulation. The smaller the per cent. of startoline added to the starter milk and the lower the temperature at which it is kept the longer will be the period of time between inoculation and coagulation.

It will be noticed in Table I that the range of temperatures given are not so great when large quantities of starter milk are used as when smaller quantities are used. This is due to the fact that the larger the quantity of milk the less does it change in temperature during the ripening period. Small quantities of milk naturally are more subjected to changes in temperature. This is especially true in very cold and very warm weather when temperatures go to either extreme.

Being influenced by these conditions the average temperature at which the starter can be grown may vary from 64° F. to 68° F. with practically the same results.

When the starter is at the point of coagulation at a temperature higher than 64° F.—66° F. and is not to be used at once immediate cooling is imperative since the starter is likely to become overripe and whey off, a condition in which a starter is almost unfit for use as its action is greatly impaired by this condition and the effect it should produce is partly or wholly destroyed. It is a good plan to see to it that the starter coagulates at a temperature lower than 64° F. if it is not to be used at once, since when coagulation takes place at a comparatively low temperature the texture of the starter is more likely to be loose and silky. When in this condition it will when poured have the appearance of nicely ripened cream and will leave no streaks, nor will it show specks or particles of curd. On the other hand starters grown at too low temperature and for too long a

period of time before coagulation invariably develop sour, slightly bitter, rank or flat flavors thereby impairing their usefulness for perpetuation. It is perhaps needless to say that the startoline should not be saved out from the starter. During the hot season the starter should not be inoculated in the morning for the next morning's use unless perfect control of temperature can be had because when it has developed quite a degree of acidity before cooling in the evening it is difficult to prevent its becoming overripe before it is used next morning. When the starter milk is inoculated in the evening with startoline of good quality and proper acidity the starter will as a rule be in good condition in the morning. During cool weather however, there is not much danger of the starter spoiling when set in the morning, cooled a little before evening and the ripening finished at a lower temperate.

USING STARTERS EVERY OTHER DAY.

When the starter is used only every other day it is always better to renew the startoline daily and reheat the starter milk the second day than to hold over both the starter and startoline. By holding over the startoline and starter the development of acid may be too rapid and by producing an excess of acid the quality of both the startoline and starter is impaired and may be spoiled altogether, or cheesy, curdy or vinegar flavors produced.

TOO HIGH ACID STARTERS.

It is a well known fact that after the acidity in the startoline or starter has developed to about .8% the strength of the acid present retards and finally prevents the production of a good quality of lactic acid necessary in butter or cheese making. After such a stage is reached the quality of the acid undergoes changes. The first change noticeable is the change to a vinegar flavor, a little later it will show signs of wheying off and then in many cases a digesting of the curd begins. All these signs are indications of the weakening of the lactic acid germ. Therefore great care must be taken to prevent the development of too high acid in the startoline. It should not have more than .7% acid at any time and it is best not to exceed .65% in order to maintain a fine quality of acid in both startoline and starter. A high degree of lactic acid weakens the lactic acid germ and in many cases kills it.

RIPENING STARTERS.

The degree of acidity to which starters are ripened before being added to cream varies according to reports from 100 of the best creamerymen in the United States from .45 to .80%. This variation is due to different methods of handling and ripening cream and different methods of using the starter. The degree of acidity also depends upon the kind of cream handled—that is whether it is whole milk or hand separator cream.

TABLE II.

Grouping the One Hundred Creameries Showing the Degree of Acidity to Which the Starter Was Ripened.

Number of Creamerymen using the same per cent. of Acidity.	5	5	16	21	22	22	4	5	Total 100
Per cent. of Acidity.	.45	.50	.55	.60	.65	.70	.75	.80	A'v'g .62

The average of .62% is about the proper acidity which the starter should have for butter making in the average creamery. Where hand separator cream is used the starter may be ripened to a higher acid than where whole milk cream is used. The greater the extent of undesirable fermentations in cream the higher may the starter be ripened. However I should not advise ripening the starter higher than .75%.

REGULATING THE QUALITY OF ACID IN BOTH STARTOLINE AND STARTER.

When startoline, due to neglect in handling, produces a low acidity and a sweet flavor in the starter this can be remedied by ripening the startoline to a higher degree of acidity for several days. Also if the starter is not properly handled and is slow in coagulating, its activity can be increased by ripening the startoline at a temperature higher than usual and using a larger

quantity of startoline. The slowest startoline can be made more active by a few days of this treatment. If a starter is too acid in flavor it can be brought back to a mild pleasant flavor by ripening it to a lower degree of acidity. This is especially noticeable if the starter is cooled to about 56° F. soon after it is set, before the acidity has developed much, held at this temperature about 5-8 hours and then warmed to about 75° F. in order to hasten coagulation. On examination at the time of coagulation it will be found that the acid is of a mild pleasant taste. When this method is used the starter must be used at once because the high temperature favors curdling and wheying off and the possible production of alcoholic fermentations.

THE PINK OR BROWN STARTER.

Heating the starter milk twice to about boiling point has a very detrimental effect on the quality of both the milk sugar and the lactic acid. There are more starters spoiled by overheating the milk than many butter makers imagine. The milk invariably takes on a brownish color when overheated. This indicates that the milk sugar has caramelized by reason of having been scorched. By changing the condition of the sugar, an inferior quality of lactic acid is produced. It is only natural that when the milk sugar is scorched, the starter will have a burnt flavor. This flavor is also imparted to the butter by the use of such a starter and it destroys the fine "bouquet" so desirable in butter. Such a starter is usually spoken

of as a pink or brown starter and as having a scorched or burnt flavor.

BURNT FLAVOR IN STARTER DUE TO MILK USED.

There is a peculiar flavor in the milk of some herds during the fall, known as a burnt flavor. This peculiarity usually manifests itself more frequently during the corn cutting season than at any other time of the year. This flavor seems to be due to the excessive feeding of corn stalks, corn stubbles, frozen grasses and half dead herbage. Dairymen know that corn cutting knives and the knives of the feed cutter become heavily coated with a gummy, sweetish substance from the juices of the corn. This smells a trifle tarry and the same odor can be found in the milk when it flows from the separator or when heated in the starter can. I have known many instances where this flavor was easily noticeable in the starter and also in the butter made from such milk.

JUDGING STARTERS.

The same scale of points applies to the judging of the starter and of the startoline. Also in nearly every case the defects found in one will be found in the other. The startoline should sour in a reasonable length of time if so intended by the person in charge of it. The body should be smooth and firm when well coagulated and it should be free from gas bubbles and whey. When shaken up and poured it should resemble the consistency of well ripened cream and should be smooth and free from lumps and granulations. The aroma should be of a

clean, pure, acid nature, and be reasonably pronounced. The flavor should be clean and without cheesy or curdy taints. When broken up by shaking and held at a low temperature it should not whey off very soon. Wheying off readily indicates the weakening of the lactic acid organisms, and the appearance of flat,weak or dull flavors. When such a condition arises a new culture must be set at once, since the starter shows signs of "running out" and may at any time fail to produce a good flavored acid.

A STARTER SCORING BLANK.

Name.....Date.....

Address .....

	Perfection Points	Remarks
Aroma	20	Clean, slightly acid, reasonably pronounced, free from taints.
Flavor	50	Clean, mild acid taste, free from curdy, cheesy and fermented flavors.
Body	30	Before breaking up—close, smooth, no gas bubbles; after breaking up—smooth, creamy, silky.
Total	100	

USE GLASSWARE.

Whenever obtainable, glassware should be used in growing the startoline, because when glassware is cleaned and sterilized it may be stoppered and left for a day or longer without acquiring a bad odor. The only smell which manifests itself upon opening a glass vessel which has been closed for some time is a dead-air smell. This is not the case with a tin vessel, for no matter how carefully cleaned and sterilized it may be, if it is closed tightly for several hours a very offensive odor is noticeable upon opening it. This odor somewhat resembles fermented milk or an old tin can. Due to contamination from this source all tinware used for growing the startoline should he discarded and replaced by glass vessels. A few glass quart or gallon jars with glass stoppers, in addition to the utensils already at hand are all that are needed for handling the startoline. Glass jars can very easily be sterilized either by boiling them for five minutes or by applying live steam to them by placing them under a pail turned over a steam jet. Glassware should be used in handling the startoline whether it be in a large or a small creamery. Where large quantities of startoline are required use several gallon jars with glass stoppers.

UTENSILS WHICH SHOULD NOT BE USED.

China ware should not be used because the glazed surface cracks very easily and the vessel will absorb milk which will create offensive odors and contaminate the

startoline. Earthenware, such as crocks of any type should not be used as they are worse than China ware. Either China or earthenware can be used only for a short time, if necessary to use them at all, and then must be thoroughly cleaned and aerated before each time they are used.

High grade enameled ware is very good and may be classed next to glassware for use in the handling of startoline. Aluminum utensils are now being used in some creameries and promise to be among the best utensils for handling startoline.

Utensils in the order of their usefulness:

1.—Glass. 2.—Enameled Ware. 3.—Aluminum Ware. 4.—High Grade China. 5.—Tinware. 6.—Earthenware.

KEEP FLIES FROM THE MILK.

We need hardly mention what a nuisance flies are around creameries and cheese factories, for this is well known. In order that we may more fully comprehend the importance of keeping the flies from falling into the milk or getting at the same for refreshment, we wish to call attention to some experiments carried on by Prof. F. C. Harrison of Ontario Agricultural College as given in Bulletin No. 41, in which he says: "Single flies were placed in test tubes containing a measured quantity of sterilized water and well shaken. This water on analysis was found to contain large numbers of gas producing bacteria. Frequently 50,000 bacteria were ob-

tained from a single fly and of these over 20,000 were gas producing. Is it any wonder that the startoline or starter does not always turn out as well as it should? I wish to emphasize the fact that it is not the pure culture that produces gas in starters but the milk that was used which may have been contaminated by uncleanly handling, or by imperfect pasteurization. Instances are known where the starter milk after pasteurization and cooling to 80° F. has risen up and crowded out of the starter can and the gassy curd fell onto the floor beside the starter can. This was due to gassy fermentation and these fermentations are very destructive to the finer flavors in butter or cheese. No high scoring butter can be made from cream in which gassy fermentations are present in any great degree.

STARTERS IN CREAM RIPENING.

It has been found by both scientific men and practical dairymen that natural ripening of cream favors the development of undesirable flavors, unless the cream so ripened was produced and handled under the best sanitary conditions. Ideal sanitary conditions on dairy farms and in creameries do not as a rule now exist. Therefore in order that cream may be more uniformly ripened from day to day regardless of external conditions and minor contaminations a pure lactic ferment culture has been found indispensable in the controlling of undesirable fermentations in cream

RAW OR PASTEURIZED CREAM.

Starters should be used in both raw and pasteurized cream but it is only in pasteurized cream that the full benefit of a starter is realized, because in this cream lactic acid can develop without the interference of other fermentations. In raw cream, as a rule a great variety of other fermentations thrive and therefore the full benefit of the starter is not always realized. Lactic acid develops faster in pasteurized than in unpasteurized cream. The poorer the cream is in quality the larger should be the quantity of starter added to it.

PER CENT. OF STARTER TO BE ADDED TO CREAM.

The per cent. of starter necessary to be added to cream depends upon: (1) the quality of the cream; (2) the richness of the cream; (3) the kind of cream, whether whole milk or hand separator cream; (4) the temperature of the cream during ripening; (5) how long the cream is to ripen until the necessary acid has developed. In the order as mentioned above: (1) when the cream is impure add more starter; (2) the richer the cream the larger the per cent. of starter should be added (page 27); (3) hand separator cream as a rule needs more starter than whole milk cream (page); (4) the higher the temperature of the cream the smaller is the per cent. of starter to be added, and the lower the temperature of the cream the larger is the per cent. of starter to be used in order that the cream may ripen

in the allotted time; (5) the longer the time allowed for the cream to ripen the smaller is the per cent. of starter necessary to use and the shorter the ripening period the larger must be the per cent. of starter used.

RICHNESS OF CREAM AND PER CENT. OF STARTER.

The following table shows the number of pounds of starter that may be added to cream containing a given per cent. of butter fat and still have cream of churnable richness.

TABLE NO. III.

Per Cent. of Starter Added to Cream.

Test of cream before add. starter	Different Quantities of Starter added to every 100 lbs. cream.	Test of Cream after adding the Starter.
60% Cream	Adding 100 lbs. starter " 50 " " " 40 " "	Test after add. S. 30% " " " " 40% " " " " 46%
50% Cream	Adding 100 lbs. starter " 50 " " " 30 " "	Test after add. S. 25% " " " " 33% " " " " 38%+
45% Cream	Adding 75 lbs. starter " 50 " " " 25 " "	" " " " 25%+ " " " " 30%+ " " " " 36%+
40% Cream	Adding 75 lbs. starter " 50 " " " 25 " "	" " " " 23%+ " " " " 26%+ " " " " 32%

35% Cream	Adding	50	lbs.	starter	"	"	"	"	23%+
	"	40	"	"	"	"	"	"	25%
	"	20	"	"	"	"	"	"	29%+
30% Cream	Adding	30	lbs.	starter	"	"	"	"	23%+
	"	25	"	"	"	"	"	"	24%
	"	20	"	"	"	"	"	"	25%
25% Cream	Adding	20	lbs.	starter	"	"	"	"	21 -%
	"	15	"	"	"	"	"	"	22 -%
	"	10	"	"	"	"	"	"	23 -%

TEMPERATURE AND TIME.

The best temperature for ripening cream at the average creamery is 67-69° F. in summer and 68-71° F. in winter. Where a large per cent. of starter is used in cream lower temperatures may be used than when small quantities of starter are added. Due to these and other variations previously mentioned no definite length of time can be given in which to ripen cream. Considering the possible action of lactic acid and other fermentations on butter fat during the ripening period it seems that the shorter the period consumed in ripening cream the better is the quality of the butter. Try to adjust things so as not to ripen cream for a longer period than eight hours nor for a shorter period than three hours.

A FEW THINGS TO REMEMBER.

Remember that the lactic acid germ is a tiny, delicate plant.

That heat may very easily destroy its life.

That cold does it no injury whatever.

That high acid weakens and finally kills it.

That a temperature between 65-75° F. is most favorable for the production of a good quality of acid.

Always use a thermometer when setting the starter.

Never pasteurize without knowing the time and temperature applied.

Never use old, acid or unclean milk.

Never use anything but glassware or enameled ware for handling your startoline.

Have a well tinned starter can. Copper is poison to the good flavor of lactic acid. Pay proper attention to the details of the handling of the startoline and a good quality of lactic acid will be the result.

Try to be a good judge of conditions as they arise.

Do not think that the starter will take care of itself.

Do not think that any kind of sweet milk is good for making a first-class starter.

Do not shake up the startoline until it is to be used. This also applies to the starter.

CHR. HANSEN'S
Celebrated
Danish Dairy Preparations.

CHR. HANSEN'S LACTIC FERMENT CULTURE

is so well known to all up-to-date butter and cheese makers as to need but little description here.

The **"Small Package"** for two quarts of Startoline has proven to be large enough for any ordinary creamery or cheese factory and, as a rule, renewal once in two weeks is sufficient.

It makes a **vigorous** starter, ensuring high flavor, perfect aroma, keeping quality and uniformity in butter. In cheese making it does away with gassy curd and produces a curd of uniform and perfect consistency.

Chr. Hansen's Culture,

being a dry powder, has great keeping quality and can safely be kept in stock for several months. It is advisable to always have an extra package on hand with which to promptly start a fresh propagation of Startoline in case of accident to the one running.

Standing Orders for 3 packages to be sent every six weeks are on our books from many first-class butter and cheese makers all over the country. May we enter yours?

CHR. HANSEN'S DANISH RENNET EXTRACT

is known as **The Standard,** not only in every state of the Union in which cheese is made, but also in Canada, Australia and Europe, in fact

All Over the World.

Its high qualities are strictly maintained and that is the secret of its popularity which never was greater than now.

Considering its strength, it remains the **cheapest** coagulating agency per 1,000 lbs. of milk if not per gallon of extract.

See that you get the genuine "Hansen's".

CHR. HANSEN'S DANISH CHEESE COLOR

has never yet been equaled in beauty, clearness and strength, imparting as it does the beautiful creamy, orange color so much appreciated in cheddar cheese.

It is a Purely Vegetable Annatto Color.

Cheese Merchants are particular that none but the best color should be used.

What does the saving of say 25 cents per gallon amount to? Let us see! A gallon is 128 ounces. If you use 1½ oz. per 1,000 lbs. of milk or 100 lbs. of cheese, a gallon will make 8,533 lbs. of cheese.

It does not take much of inferiority in color to decrease the value of the cheese by ¼ cent per lb. or $21.33 for the 8,533 lbs. of cheese. Would it pay to try and save 25 cents at the risk of losing $21.33 or more?

Chr. Hansen's Cheese color has stood the severest test for forty years and has come out ahead of all competitors to this day.

CHR. HANSEN'S DANISH BUTTER COLOR

The Purest and Strongest Vegetable Butter Color That Can Be Manufactured—The Kind that Does Not Add Taste or Odor to the Butter.

Since the coal tar colors were abolished our Danish Butter Color, which has been used in the famous Danish butter for 40 years, has come to the front again also in this country and is now sweeping the field securing the highest scores at most exhibitions for the butter makers who are using it.

CHR. HANSEN'S UNRIVALED RENNET TABLETS AND CHEESE COLOR TABLETS

are exceedingly handy for cheesemaking at home on the farm.

They can be sent by mail at a trifling cost and their curdling and coloring power is astonishing.

They are for sale by druggists in all dairying sections.

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CHR. HANSEN'S FAMOUS JUNKET PREPARATIONS

consist of

Junket Tablets for dainty milk desserts and ice cream.

Junket Cream Tablets for manufacturers of ice cream on a larger scale than in the ordinary household.

Junket Brand Buttermilk Tablets to make pure, clean, refreshing buttermilk or Lactic Acid milk at home.

Junket Brand Colors (Raspberry Red, Orange Gold and Lemon Yellow) and **Junket Brand Flavoring Extracts**. (Vanilla, Lemon, Orange, Almond, Nutmeg, Clove, Allspice, Ginger, Cinnamon, Rose, Peppermint and Wintergreen) of the highest quality. Dairymen making ice cream are especially urged to try our exquisite Vanilla and other flavoring extracts as well as our beautiful colors, which are as pure as our Dairy Preparations.

CHR. HANSEN'S LABORATORY,
Little Falls, N. Y

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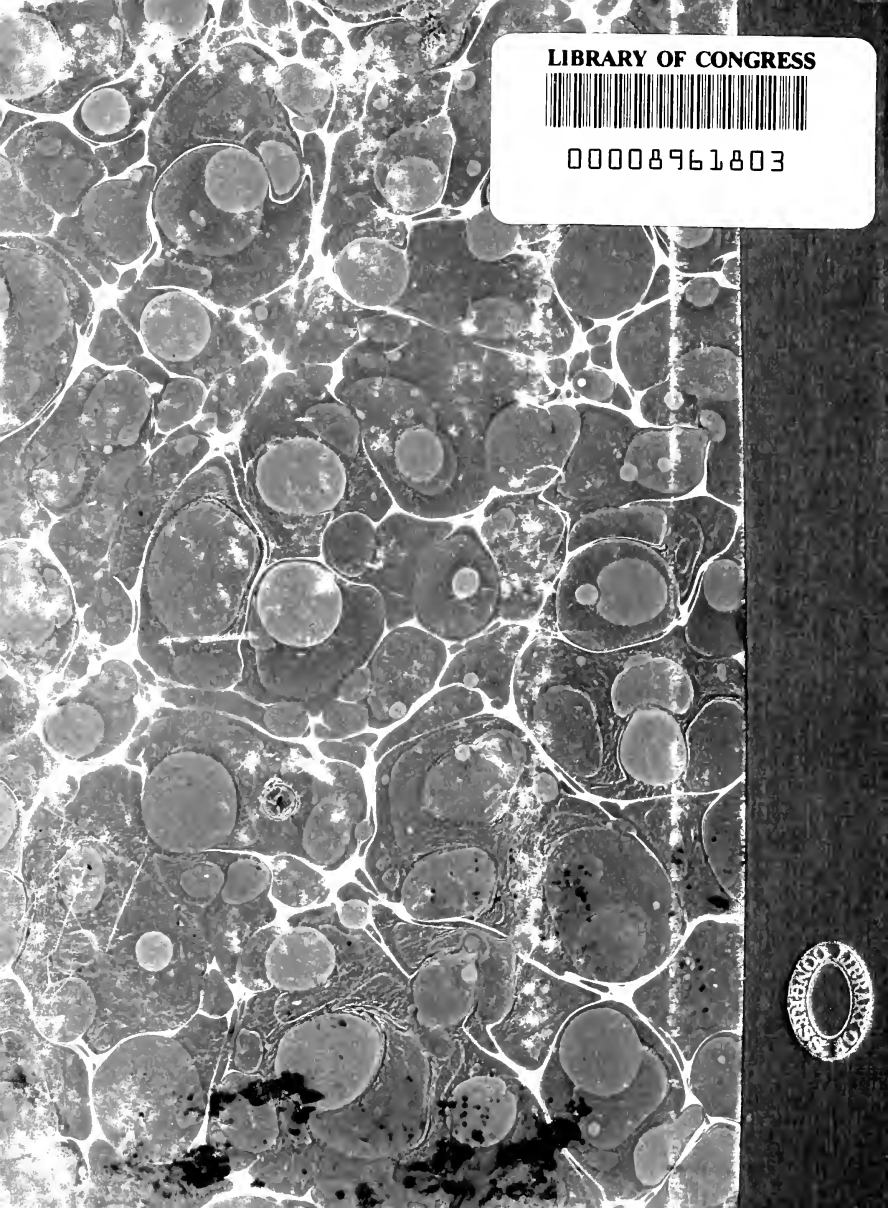
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